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DATA BASE SUPPORT FOR SIO (SYSTEM INTEGRATION OFFICE)

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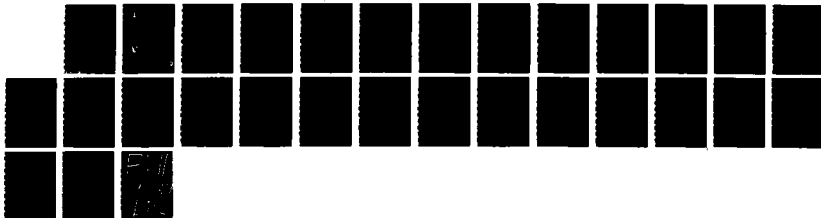
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TECHNICAL REPORT RD-CR-84-19

DATA BASE SUPPORT FOR SIO

Prepared for
Systems Simulation and Development Directorate
US Army Missile Laboratory

James D. Marr, Laura Pritchett
and Bill Wells
School of Engineering
The University of Alabama in Huntsville
Huntsville, Alabama 35899

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| 20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This activity was divided into two parts, data support and software development. Two S10 databases were supported; end of Run and Test Matrix. Enhancements to the FEASIL relational database system included plots, ADF restructuring, and formatted data output. | | |

SECURITY CLASSIFICATION OF THIS PAGE(When Data Entered)

PREFACE

This technical report was prepared by the Research Staff of the Electrical Engineering Department, School of Engineering, The University of Alabama in Huntsville. The purpose of the report is to provide documentation of the technical work performed and results obtained under delivery order 0015 of MICOM Contract No. DAAH01-82-D-A008; Dr. N. A. Kheir, Principal Investigator.

The project documented herein was performed by Laura D. Pritchett, Bill Wells and Dr. James D. Marr. Dr. M. M. Hallum, III, Chief, Systems Evaluation Branch, Army Missile Laboratory, U. S. Army Missile Command, was technical monitor.

The authors wish to acknowledge the valuable discussions and assistance provided throughout the task by Terry N. Long of UAH.

The technical viewpoints, opinions, and conclusions expressed in this report are those of the authors and do not necessarily express or imply policies or positions of the U. S. Army Missile Command.

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As the quantity of System Integration Office (SIO) data has grown, it has become very useful to have the data in a more accessible form. The FEASIL database management system was chosen as a tool to achieve this goal. The task reported here was divided into two parts, support of two data bases and enhancement of the FEASIL system. The work on the SIO databases is reported in Section 2. The new FEASIL plot capabilities are reported in Section 3. A final section contains conclusions and recommendations.

2.0. DATA BASES

```

I  intergers (e.g. -23, 1776, or 15)
FP floating point (e.g. 3.14, -.05, or 930000000.)
C  single character (e.g. N, S, E, W, or 3)
S  strings of characters (e.g. FRED, VERY VERY LONG STRINGS OF WORDS,
                           or THE 3RD EXAMPLE WHICH CONTAINS THE DIGIT
                           3 TWICE)

```

The column labels for each column and the number of tuples (rows) for each relation are shown next. We cannot comment on the meaning of column headings, or the units used (English vs. metric), or the meanings of letters in the C columns.

2.1 SIO End of Run

The SIO End of Run data is stored in four relations: RELA1, RELA2, RELA3, and RELA4. The column number, strategy, and column headings for RELA1 are as follows:

| column | strategy | heading |
|--------|----------|---------|
| 1 | I | COL1 |
| 2 | I | COL2 |
| 3 | I | COL3 |
| 4 | I | COL4 |
| 5 | FP | COL5 |
| 6 | FP | COL6 |
| 7 | FP | COL7 |
| 8 | FP | COL8 |
| 9 | FP | COL9 |
| 10 | FP | COL10 |
| 11 | FP | COL11 |
| 12 | FP | COL12 |
| 13 | FP | COL13 |
| 14 | FP | COL14 |

RELA1 has 1166 tuples. The remaining 3 relations have the same number of tuples (1166), the same strategies, and the same column headings; only the number of columns differs. RELA2 has 13 columns, RELA3 has 10 columns, and RELA4 has 11 columns.

2.2 SIO Test Matrix

The SIO Test Matrix is stored in a single matrix, MARK. The column numbers, strategies, and column headings for the relation are as follows:

| column | strategy | heading |
|--------|----------|---------|
| 1 | I | CC |
| 2 | I | D |
| 3 | I | FRN |
| 4 | I | TRN |
| 5 | I | M |
| 6 | I | R |
| 7 | I | X |
| 8 | I | P |
| 9 | I | S |
| 10 | I | TC |
| 11 | I | SL |
| 12 | I | BP |
| 13 | I | DC |
| 14 | S | NOTES |
| 15 | I | GT |
| 16 | I | T/T |
| 17 | I | EM/B |

| column | strategy | heading |
|--------|----------|---------|
| 18 | I | HS |
| 19 | I | VS |
| 20 | I | MS |
| 21 | I | ST |

There are 519 tuples.

3.0 FEASIL

The FEASIL system was modified and enhanced in several areas, resulting in a version called FEASIL 7. Under Delivery Order 0015, a plot capability was added. Included herein are conversion to run under FORTRAN 77, friendliness changes, ADF changes to conserve disk space, and other alterations. The remainder of this section describes the plot capability briefly (Appendix A shows more detail) and the other changes in more detail.

3.1 Plots

The plot capability was developed by Dr. M. Castellano, based on code from Melsa and Schultz. The plot routine is a function within main menu item 7, Retrieve and Manipulate data. It is possible to plot up to 5 columns as a function of another column, either as a scatter plot or with lines between the data points. Output devices supported include plotter (not fully tested), printer, or terminal screen. A more complete description is supplied as Appendix A, the "plot" pages from the FEASIL cookbook.

3.2 Output for Use by Other Programs

FEASIL has a limited statistical capability: it can compute mean and variance for one variable. There are many non-FEASIL statistical packages available, but they require text input. FEASIL now can output values to a file for use elsewhere. This capability is accessed through main menu item 7, Retrieve and Manipulate, and subfunction P, Print.

3.3 FORTRAN 77 Conversion

FEASIL has been converted to FORTRAN 77 (FORTRAN 7 on the Perkin-Elmer computer) with a Flex preprocessor. FORTRAN 77 has several features that were not available under FORTRAN 4, but it also has some incompatibilities with both the FORTRAN 6 (Perkin-Elmer) and the Flex preprocessor. A solution has been found for most problems.

The FORTRAN 77 CHARACTER data type has proven useful in several places. Conversion of formats from Hollerith to quoted strings has improved code readability, simplified modification, and eliminated some format

The largest conversion problem was related to the ELSE keyword. FORTRAN 77 added an

```
IF (...) THEN
...
ELSE
...
ENDIF
structure for block conditionals. Flex has an
IF (...)
...
ELSE
...
FIN
```

structure for that purpose. The Flex preprocessor passes the IF line because it does not match, but becomes confused when it encounters an ELSE without a corresponding FIN. The solution was to use the Flex form for any block conditional with an ELSE block; use of the FORTRAN 77 form for the other block IF's results in cleaner code for the compiler.

3.4 Friendliness to the User

The most visible change to the inexperienced user is the addition of menus to the more complex activities on the main menu: item 3 (Edit) and item 7 (Retrieve and Manipulate). If the user gives an illegal command, the system supplies a reminder that function H (Help) displays a list of the legal commands with a brief description of each.

Several diagnostic messages were modified to provide more information. Additionally, some messages were added to reduce anxiety in the user. User surveys to find other useful changes will continue.

3.5 ADF Changes

A FEASIL relation consists of three files: the TDF to contain structure information, the TF to contain numeric and character data, and the ADF to contain string data. Each ADF record will store up to 256 characters, so this is the maximum string length; unfortunately, the entire record is used even if the string is only one character. Each tuple file (TF) record consists of 64 words. Each TF word can store an integer value, a Floating point value, or a single-character value; two TF words are required for a string strategy item. This description fits both FEASIL 6 and FEASIL 7.

An analysis was made of several relations to determine ADF usage. Typically, 95% of the strings were less than 60 characters long and half the strings were 8 characters or shorter. If the ADF record were reduced to 60 characters (with provision for multirecord strings), then the disk space needed for the ADF would be reduced nearly 75%; unfortunately, all files would have to be reprocessed to convert between FEASIL 6 and 7 because of ADF incompatibility. As an alternate approach, if the ADF were not used for strings 8 characters or shorter, then disk usage would be reduced about 50%. The second approach was chosen for FEASIL 7.

Under FEASIL 6, the two TF words are used to store

- a) the string length (1-256)
- b) the ADF block number of the string (1-max)

and the ADF has a 256 character capacity for each string with nonzero length. Under FEASIL 7, strings over 8 characters are stored as before; shorter strings are stored in the two TF words thus:

- a) first 4 letters
- b) second 4 letters

with ASCII nulls for letters not used and no ADF usage. Decoding the string is performed thus:

- 1) Examine the first TF word; if it is 256 or less, go to 2; if it is over 256³, go to 3; otherwise, go to 4.
- 2) This is either a FEASIL 6 entry or a string longer than 8 (or both); get the string from the ADF.
- 3) This is a short string under FEASIL 7 because it has a character in the first - character position of the TF word; get the string from the two TF words and find the length by inspection.
- 4) This is an error; report it.

FEASIL 7 can operate on FEASIL 6 relations, and will maintain downward compatibility as long as it is not used to store a string of 8 characters or less. Conversion is achieved conveniently by using the R(reproduce a relation) function of main menu item 7 (retrieve and manipulate), but several other conversion methods are possible.

3.6 Known Problems from Conversion

The most important remaining problem due to the conversion is size; FEASIL 7 is about 50% larger than FEASIL 6 while being executed. Two approaches are being used to solve this problem. First, we used the 7D compiler, which is less space-efficient; changing to the optimizing 7D compiler should reduce the size some. Second, we have run an analysis of subroutine calls and of the current overlay structure. Many routines are loaded in the root that are not needed by the largest overlay, and there were even four subprograms that are not used. A major restructuring of the libraries and overlays will reduce the space needed.

4.0 CONCLUSIONS AND RECOMMENDATIONS

Since this task was divided into two areas, the recommendations are presented separately for the two subjects.

It was observed that data tends to be corrupted on the Perkin-Elmer computer; hardware and other problems have frequently destroyed all data on a disk. We recommend that backup tapes for the SIO relations be maintained at two separate locations to protect the data, and that the copies on the computer be checked regularly to verify data integrity.

FEASIL 7 should be phased-in gradually with phases for testing, training, and final changeover. The libraries and overlays should be rearranged to reduce routine space requirements. Further analysis may reveal more areas for rearrangement.

APPENDIX

Manual Pages - Plot Function

The Feasil Plotter User's Guide

The FEASIL PLOTTER is an interactive plotting program which allows the user to generate scatter plots of up to 5 columns of a relation as a function of 1 column. The plots can be displayed on the CONSOLE, on a LINE PRINTER, and if available, on a VARIAN STATOS PRINTER/PLOTTER (=PLOTTER). In the latter case, the user has the option of connecting the data points with line segments and the option to select axis labels.

Initial Operations

In order to engage the FEASIL PLOTTER the user must select the D (DISPLAY) option from the RETRIEVE, MANIPULATE, AND PLOT DATA menu. The user will then be asked to enter the column number which will represent the x-axis (independent) variable. Following a valid response, the user will be asked to enter up to 5 column numbers to represent the y-axis (dependent variables). For notational purposes, the pairing of the x-axis variable with the first user selected y-axis variable will be called FUNCTION 1. Likewise, define FUNCTION 2 through FUNCTION 5. After the last function is entered, a STATUS REPORT will be printed on the CONSOLE, and the FEASIL PLOTTER prompt PLOT> will appear.

For the purpose of illustration, consider the following relation:

RELATION NAME: TESTPLOT

| COLUMN 1 X-AXIS VARIABLE | COLUMN 2 FUNCTION 1 | COLUMN 3 FUNCTION 2 | COLUMN 4 FUNCTION 3 |
|-----------------------------|------------------------|------------------------|------------------------|
| -3 | 9 | -1 | 5 |
| -2 | 4 | 0 | 5 |
| -1 | 1 | 1 | 5 |
| 0 | 0 | 2 | 5 |
| 1 | 1 | 3 | 5 |
| 2 | 4 | 4 | 5 |
| 3 | 9 | 5 | 5 |
| 4 | 16 | 6 | 5 |
| 5 | 25 | 7 | 5 |
| 6 | 36 | 8 | 5 |

SAMPLE DIALOG

FEASIL7

*** YOU ARE IN DMS(VER F7.00). DO YOU WANT TO:

- 0) QUIT
- 1) CREATE A NEW RELATION
- 2) DELETE A RELATION
- 3) EDIT A RELATION
- 4) MODIFY COLUMN SPECIFICATIONS
- 5) MERGE TWO RELATIONS
- 6) REORGANIZE A RELATION
- 7) RETRIEVE, MANIPULATE, OR PLOT DATA
- 8) BACKUP A RELATION
- 9) STATUS OF DATABASE

ENTER SELECTION BY NUMBER >
>7
NAME OF RELATION TO BE MANIPULATED?>
>TESTPLOT

WHAT IS THE NAME OF VOLUME YOU ARE USING?

>MT6A

ENTER WRITE KEY (0-124) >

>0

ENTER READ KEY (0-124) >

>0

<<RELATION WITH THAT NAME ALREADY EXISTS ON THAT VOLUME!>>
READY FOR MANIPULATION>

>

>0

COLUMN NUMBER FOR THE X-AXIS VARIABLE>

>1

COLUMN NUMBER FOR THE Y-AXIS VARIABLE>

>2

DO YOU WISH TO ADD ANOTHER FUNCTION
TO THE DISPLAY? <YES OR NO>

>YES

COLUMN NUMBER FOR THE Y-AXIS VARIABLE>

>3

DO YOU WISH TO ADD ANOTHER FUNCTION
TO THE DISPLAY? <YES OR NO>

>Y

COLUMN NUMBER FOR THE Y-AXIS VARIABLE>

>4

DO YOU WISH TO ADD ANOTHER FUNCTION
TO THE DISPLAY? <YES OR NO>

>N

STATUS REPORT

** X-AXIS **

COLUMN 1 NAME: X-AXIS VARIABLE

DATA RANGE: (-3.0,6.0)

AXIS RANGE: (-3.0,6.0)

** Y-AXIS **

AXIS RANGE: (-1.0,36.0)

COLUMN 2 NAME: FUNCTION 1

DATA RANGE: (0.0,36.0) MARKER = *

COLUMN 3 NAME: FUNCTION 2

DATA RANGE: (-1.0,8.0) MARKER = 2

COLUMN 4 NAME: FUNCTION 3

DATA RANGE: (5.0,5.0) MARKER = 3

PLOT>

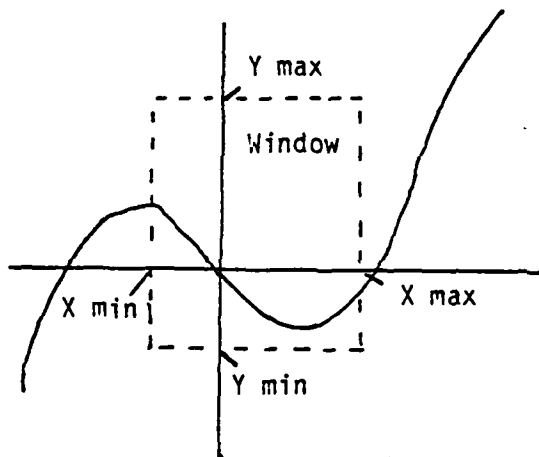
>

The following are definitions of some of the terms in the STATUS REPORT.

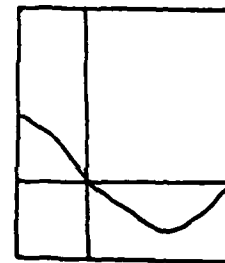
(a) DATA RANGE: (DMIN,DMAX) — The data range contains the minimum (DMIN) and the maximum (DMAX) data points in the corresponding column.

(b) AXIS RANGE: (AMIN,AMAX) — Since the x-y plane is infinite in extent, it cannot be realistically mapped onto the (finite) display screen. Instead, only a "window" in the x-y plane will be displayed. The window is determined by 4 values:

- (1) XMIN - the minimum x value which can be displayed.
- (2) XMAX - the maximum x value which can be displayed.
- (3) YMIN - the minimum y value which can be displayed.
- (4) YMAX - the maximum y value which can be displayed.



X-Y Plane



Display Surface

The x-axis range is (XMIN.XMAX) and the y-axis range is (YMIN.YMAX). Initially, the FEASIL PLOTTER will set the axis ranges so that all data points will be in the window. The user can alter these values by selecting the X-AXIS or Y-AXIS command from the FEASIL PLOTTER menu (see Section 4.1.X.2).

(c) MARKER — A marker is a symbol used to represent a function on the display. For instance, when displaying the plots on the CONSOLE or the LINE PRINTER, an asterisk(*) is used to represent FUNCTION 1.

| FUNCTION | CONSOLE/PRINTER MARKER | PLOTTER MARKER |
|----------|------------------------|---|
| 1 | * | * |
| 2 | 2 | X |
| 3 | 3 | X |
| 4 | 4 | 1 |
| 5 | 5 | 1 |

3

Interactive Procedures and the FEASIL Plotter Menu

Once the FEASIL PLOTTER prompt PLOT> appears on the CONSOLE, the user may respond with any of the following commands:

| | |
|--------|--|
| QUIT | To terminate plotting program. |
| RESET | To reset the plotting program. |
| STATUS | To print status report. |
| X-AXIS | To set x-axis range. |
| Y-AXIS | To set y-axis range. |
| PLOT | To display the plot. |
| LINE | To connect data points with line segments. |
| LABEL | To select x and y axis labels. |
| ? | To list the legal commands. |

In this section all the menu commands except LINE and LABEL are discussed. LINE and LABEL only effect the plots that are displayed on the PLOTTER and will be considered in Section 4.1.4.

The part of a command which is enclosed in parentheses "()" is optional and need not be typed by the user. Some commands have options which are separated from the command word by a colon(:). In all cases except the command STATUS, these options allow the user who is already familiar with the FEASIL PLOTTER to pass parameters to the program without having to respond to various prompts. All commands will function without options. In the event that the user enters an invalid command, a menu of the valid commands will appear on the CONSOLE. All commands must follow the PLOT> prompt and must begin in the first character position after the PERKIN-ELMER prompt(>).

QUIT

Syntax: Q(UIT)

This command causes the program to return to the RETRIEVE, MANIPULATE, AND PLOT DATA section of FEASIL.

SAMPLE DIALOG

```
PLOT>
>QUIT
>
>
```

RESET

Syntax: R(ESET)

This command is similar to QUIT except instead of returning to the RETRIEVE, MANIPULATE, AND PLOT DATA section of FEASIL, the user is sent back to the beginning of the FEASIL PLOTTER where he is asked to choose the column number of the x-axis variable. This will reinitialize all parameters of the FEASIL PLOTTER.

SAMPLE DIALOG

```
PLOT>
>RESET
COLUMN NUMBER FOR THE X-AXIS VARIABLE>
>
```

STATUS

Syntax: S(TATUS)
S(TATUS):L

This command causes the current values of certain parameters within the FEASIL PLOTTER to be displayed on the CONSOLE (or on the LINE PRINTER if the :L option is used).

SAMPLE DIALOG

```
PLOT>
>STATUS
```

STATUS REPORT

```
  ** X-AXIS **
COLUMN 1 NAME: X-AXIS VARIABLE
DATA RANGE: (-3.0,6.0)
AXIS RANGE: (-3.0,6.0)
```

```

** Y-AXIS **
AXIS RANGE: (-1.0,36.0)

COLUMN 2 NAME: FUNCTION 1
DATA RANGE: (0.0,36.0)    MARKER = *

COLUMN 3 NAME: FUNCTION 2
DATA RANGE: (-1.0,8.0)    MARKER = 2

COLUMN 4 NAME: FUNCTION 3
DATA RANGE: (5.0,5.0)    MARKER = 3

PLOT>
>

```

If the user wishes the status report to be sent to the LINE PRINTER, then the :L option must be used:

```

PLOT>
>STATUS:L
PLOT>
>

```

NOTE: The STATUS REPORT will be slightly modified in the event that the user has entered either of the commands LINE or LABEL sometime prior to entering the STATUS command. See the STATUS REPORT in Section 4.1.4.2.

X-AXIS

```

Syntax: X(-AXIS)
        X(-AXIS):XMIN,XMAX

```

This command allows the user to set the x-axis range (see Section 4.1.1 for the definition of axis range). The following dialog shows how to set the x-axis range to be (-50.0,50.0). To verify the changes the STATUS command is also entered. Following this, the abbreviated form of the X-AXIS command is given to change the x-axis range to (-5.0,5.0). (Note that this will have the effect of eliminating row 10 of the relation TESTPLOT).

SAMPLE DIALOG

```

PLOT>
>X-AXIS
ENTER MINIMUM VALUE FOR THE X-AXIS>
>-50.0
ENTER MAXIMUM VALUE FOR THE X-AXIS>
>50.0
PLOT>
>S

```

STATUS REPORT

** X-AXIS **

COLUMN 1 NAME: X-AXIS VARIABLE

AXIS RANGE: (-3.0,6.0)

DATA RANGE: (-50.0,50.0)

** Y-AXIS **

AXIS RANGE: (-1.0,36.0)

COLUMN 2 NAME: FUNCTION 1

DATA RANGE: (0.0,36.0)

MARKER = *

COLUMN 3 NAME: FUNCTION 2

DATA RANGE: (-1.0,8.0)

MARKER = 2

COLUMN 4 NAME: FUNCTION 3

DATA RANGE: (5.0,5.0)

MARKER = 3

PLOT>

>X:-5.0,5.0

PLOT>

>

Y-AXIS

Syntax: Y(-AXIS)

Y(-AXIS):YMIN,YMAX

This command allows the user to set the y-axis range. (See the above discussion on the X-AXIS command in Section 4.1.2.5). In the following dialog, we will set the y-axis range to (-5.0,20.0).

SAMPLE DIALOG

PLOT>

>Y:-5 20

PLOT>

>S

STATUS REPORT

** X-AXIS **

COLUMN 1 NAME: X-AXIS VARIABLE

DATA RANGE: (-3.0,6.0)

AXIS RANGE: (-5.0,5.0)

** Y-AXIS **

AXIS RANGE: (-5.0,20.0)

COLUMN 2 NAME: FUNCTION 1
DATA RANGE: (0.0,36.0) MARKER = *

COLUMN 3 NAME: FUNCTION 2
DATA RANGE: (-1.0,8.0) MARKER = 2

COLUMN 4 NAME: FUNCTION 3
DATA RANGE: (5.0,5.0) MARKER = 3

PLOT>
>

PLOT

, Syntax: P(LOT)
 P(LOT):C
 P(LOT):L
 P(LOT):P

This command causes the plot to be displayed on one of three devices:

- : C to display the plot on the CONSOLE.
- : L to display the plot on the LINE PRINTER.
- : P to display the plot on the PLOTTER.

If the user does not choose an option, then prompts will appear on the CONSOLE to ask the user to select the display device. In the following dialog, the CONSOLE is selected as the output device.

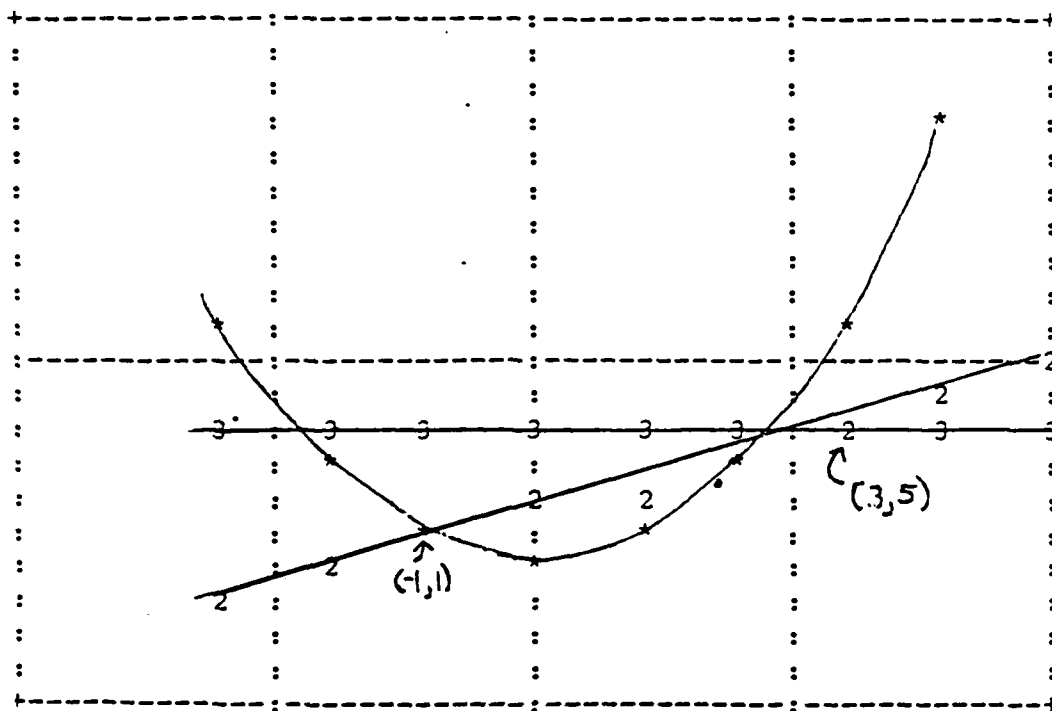
SAMPLE DIALOG

PLOT>
>PLOT

SELECT A DISPLAY DESTINATION:

- (1) TYPE C FOR THE CONSOLE
- (2) TYPE L FOR THE LINE PRINTER
- (3) TYPE P FOR THE PLOTTER

>C



?

Syntax: ?

This command causes a list of the valid commands to be printed on the CONSOLE.

Considerations for Using the Console or Line Printer as a Display Device

When using the CONSOLE (PLOT:C) or the LINE PRINTER (PLOT:L) as the display device, it becomes important to realize that these devices are low resolution graphics devices.

CONSOLE RESOLUTION: 57 x 21
LINE PRINTER RESOLUTION: 117 x 51

The most immediate problem is with the function markers in the event that more than one function is to be displayed and the data points of one function equal or become close to the data points of another function. (E.G., In the example that we are using in this documentation, the data point (1,-1) belongs to both FUNCTION 1 and FUNCTION 2. Also, (3,5) belongs to FUNCTION 2 and FUNCTION 3.) The resolution is such that we cannot plot two different data point markers at the same display coordinates. The FEASIL PLOTTER deals with this problem by assigning priorities to the function markers. The lower the function number, the higher the priority. Data points for Function 1 have priority over all other functions. Thus "*" will mark the data point (-1,1) and "2" will mark the point (3,5).

Considerations for Using the Plotter as a Display Device

For a high resolution display the user must use the PLOTTER (PLOT:P). When using the PLOTTER, the user has the option to set parameters which determine if line segments will connect the data point markers, and which determine the x and y axis labels. These commands are discussed below:

LABEL

Syntax: L(ABEL)

This command allows the user to select x-axis and y-axis labels (up to 38 characters each) for plots that are displayed on the PLOTTER. This command has no effect on plots that are sent to the CONSOLE or LINE PRINTER. When the LABEL command is entered, the user will be prompted to enter an axis label. There are two ways for the user to respond:

- (1) "axis label" — type an axis label surrounded by quote marks("").
- (2) * — type an asterisk(*). This will leave the axis label unchanged.

Initially or after the RESET command, the axis labels are blank. In the following dialog, the x-axis label is set to be THIS IS THE X-AXIS while the y-axis label is left unchanged (in this case blank). Also note that the STATUS command now gives information about the axis labels and whether or not line segments will connect data point markers. (See STATUS REPORT in Section 4.1.4.2).

SAMPLE DIALOG

```
PLOT>
>LABEL
  ** FOR PLOTTER ONLY **

X-AXIS LABEL =
>"THIS IS THE X-AXIS"
Y-AXIS LABEL =
>*
PLOT>
>
```

LINE

Syntax: L(INE)
L(INE):Y(ES)
L(INE):N(O)

The LINE command lets the user determine if line segments will connect the data point markers of functions being displayed on the PLOTTER. If no option is used, then the user will be prompted for a response. Otherwise, the :YES option will cause the line segments to be drawn, while the :NO option cancels the line segment option. Initially, or after the RESET command, the FEASIL PLOTTER is set so that no line segments are included in PLOTTER displays.

SAMPLE DIALOG

```
PLOT>
>LINE:YES
>S
```

STATUS REPORT

```
  ** X-AXIS **
COLUMN 1 NAME: X-AXIS VARIABLE
DATA RANGE: (-3.0,6.0)
AXIS RANGE: (5.0,5.0)
```

```
  ** Y-AXIS **
AXIS RANGE: (-5.0,20.0)
```

COLUMN 2 NAME: FUNCTION 1
 DATA RANGE: (0.0,36.0) MARKER = *

COLUMN 3 NAME: FUNCTION 2
 DATA RANGE: (-1.0,8.0) MARKER = 2

COLUMN 4 NAME: FUNCTION 3
 DATA RANGE: (5.0,5.0) MARKER = 3

** FOR PLOTTER ONLY **

WILL LINES CONNECT DATA POINT MARKERS? YES

X-AXIS LABEL = THIS IS THE X-AXIS
 Y-AXIS LABEL =
 PLOT>
 >

Retrieve, Manipulate, and Plot

This portion of FEASIL is used to prepare reports. One command prepares the report's output or form. Others can extract the material in the database needed to make the report. The form of the report can be a tabular data sheet or a graph. "Retrieve, manipulate, or plot data" contains the FEASIL report generator. After answering prompts for the relation you wish to use you will be ready to manipulate the data for the report.

NAME OF RELATION TO BE MANIPULATED?>
 >STATES
 (name the relation you will use for the report)
 WHAT IS NAME OF VOLUMN YOU ARE USING?
 >MT6A
 (Give the four character volumn the relation is on: ex. MT6A)
 ENTER WRITE KEY (0-124) >
 >0
 (Usually 0)
 ENTER READ KEY (0-124) >
 >0
 (Usually 0)
 READY FOR MANIPULATION>
 >

This READY FOR MANIPULATION prompt means the relation you specified can now be processed or manipulated. In this part of the program a "H" will get you the menu (see Figure 1). Typing the return key reminds you help is available.

After a few reports you will probably no longer need to enter "H" to see the choices and will just enter the commands for the parts of the program you are going to use. You may now prepare the form and content of your report.

THE LEGAL COMMANDS ARE:

| | |
|-------------------|---|
| Q (QUIT) | TERMINATES RELATION MANIPULATION |
| C (COLUMNS) | LIST NAMES OF EACH COLUMN BY NUMBER |
| R (REPRODUCE) | COPIES RELATION UNDER MANIPULATION |
| P (PRINT) | PRINTS RELATIONS DATA |
| S (SORT) | SORTS A RELATION FOR PRINTING |
| I (RE-INITIALIZE) | INITIALIZES OR RE-INITIALIZES ALL RECORDS TO ACTIVE STATE |
| A (AND) | KEEPS ACTIVE THOSE ACTIVE RECORDS THAT MEET THE SELECTION CRITERIA |
| O (OR) | MAKES ACTIVE ALL RECORDS THAT MEET THE SELECTION CRITERIA |
| M (MOVE) | MOVES ACTIVE RECORDS TO NEW RELATION |
| F (FUNCTION) | TAKES USER INTO FUNCTION MODE |
| D (DISPLAY) | DISPLAYS DATA AS PLOT |
| H (HELP) | LIST OF LEGAL COMMANDS |

Figure 1. FEASIL Manipulation Commands

The following sections give further explanations and examples of the following commands:

Quit
Columns
Reproduce
Print
Sort
And/Or/Re-initialize
Move
Function
Help
Display

(C)OLUMNS

Entering this command displays each column's name with the number the DMS is using to reference that particular column.

Dialogue

READY FOR MANIPULATION>

>

>

>C

1=NAME
2=ENTERED UNION
3=AREA (SQ. MI.)
4=TIME ZONE
5=1960 POPULATION
6=1960 DENSITY

(R)EPRODUCE

This command simply copies the current relation under a new name which you supply.

Dialogue

```
READY FOR MANIPULATION>
>
>
>R      COPIES RELATION NAME?>
>STATES2
>
```

(M)OVE

This command is similar to the (R)EPRODUCE command but only the active records (See 4.3.6) are copied into the new relation.

Dialogue

```
SELECTION PROCESS COMPLETE-ACTIVE RECORDS = 4
>
>M
RELATION TO MOVE RECORDS TO?>
>STATES3
WHAT IS NAME OF VOLUMN YOU ARE USING?
>MT6A
ENTER WRITE KEY (0-124)>
>0
ENTER READ KEY (0-124)>
>0
ERASE RECORDS AFTER MOVING?>
    <YES OR NO>
>NO
    4 RECORDS MOVED TO STATES3
>
```

(H)ELP

This command will display the menu for retrieve and manipulate as shown in Figure 1. An incorrect command or a return with no command produces a reminder that (H)ELP is available.

<<COMMAND NOT UNDERSTOOD>> TYPE "H" FOR HELP.

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END

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Dtic